PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) ARTICLES HAVING THERMOPLASTICS SURFACES

(71) We, DAVIDSON RUBBER COMPANY INCORPORATED, a corporation organized and existing under the laws of Delaware, U.S.A., of Industrial Park, Dover, New Hampshire, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to bonding thermoplastcs articles together and in particular but not exclusively to bonding decorative trim, welding, indicia and other automobile trim components consisting, at least partly, of thermoplastics material to a thermoplastics article. By "thermoplastics article" is meant an article having at least one thermoplastics surface. The trim components may for instance be as described in United States Patent Specification No. 3,123,403.

There has been a need for a method of bonding decorative trim components such as vacuum metalized plastics strips to moulded articles having an exterior covering of a thermoplastics material, e.g. an acrylonitrile-butadiene-styrene (ABS) sheeting or a polyvinyl chloride casting, without the use of an adhesive, the use of which is slow and messy and gives inconsistent results. Heat sealing with a heated platen has been tried, but this method is sensitive to control and usually results in distortion of the trim component and/or the surface to which it is to be attached.

According to the present invention two articles having thermoplastics surfaces are bonded together by applying an electromagnetic induction field to a perforated metal member in contact with the adjacent thermoplastics surfaces of the two articles so that the heat generated in the metal member by the induction field heats the thermoplastics surfaces sufficiently for the thermoplastics to penetrate the perforations of the metal member and so that when the surfaces are subsequently allowed to cool the articles become bonded together. This bonding technique is extremely rapid and versatile and has a variety of applications in addition to those mentioned above. For example, it can be used to bond indicia to thermoplastics panels to make signs, to decorate blow-moulded articles and to implant decorative strips in vinyl floors.

One of the articles may be a cast polyvinyl chloride and the other a metalised plastics component and under these circumstances the articles are preferably held together by a light pressure during the heating. The perforated metal member may be in the form of a mesh which can be constituted by filaments or strands, wire screen or expanded metal. It can be quite flexible, lending no rigidity to the articles or alternatively can have sufficient substance that one of the articles, for instance a trim component, before the bonding operation has a "snap-on" fit with the other article to which it is to be attached.

Depending on the respective softening and melting points of the two thermoplastics articles, one article may fuse through the metal member and bond with the other article, or the member may "sink" into one article. Alternatively the two can have approximately the same fusing points so that they co-mingle within the perforations of the member. Even where one of the articles is relatively thin, it is possible to so bond the articles that the pattern of the perforations does not "strike through" the thin article, for instance a decorative trim component, but on the other hand the induction heating-fusing step and the thickness of the trim component can be so chosen that the pattern

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of the perforations shows through enhancing the aesthetic appearance of the finished assembly.

Examples of other thermoplastics materials that can be used for either the trim components or supporting surfaces are sheets, films, castings, or mouldings formed, for example, from vinyl plastisol, polyethelene, polypropylene, acrylic resins, cellulose acetate, nylon, polystyrene.

A further advantage of the invention is that it permits the bonding of trim components to be carried out on an automated, conveyorized basis, for example precut trim elements with the mesh already attached can be mounted on the article to be decorated at a first station, the induction heating can be carried out with the application of pressure at a second station, the assembly forced cooled at a third station, and so forth.

Practically any frequency can be used for the induction field, e.g. from 50 KC/S to 1000 KC/S but it is preferred to operate below the communications bands which commence at about 500 KC/S.

By way of example, the invention will be described in more detail with reference to the accompanying drawings in which:—

Figure 1 is an elevation in cross-section through articles undergoing bonding to one another in accordance with the invention; and,

Figure 2 is an elevation in cross-section through articles which have been bonded to one another in accordance with the invention.

In Figure 1, two thermoplastics articles 10 and 12 each in the form of a sheet are separated by a wire mesh 11. An electromagnetic induction field is applied to the mesh 11 which is therefore heated. Consequently both of the layers 10 and 12 are heated and fuse together through the mesh 11. On cooling, the two layers 10 and 12 become bonded together.

In Figure 2, a chrome-plated strip 21 having perforations 23 is shown bonded to a sheet or covering 22 of vinyl resin. A coloured plastics strip 20 of polyvinyl chloride is located over the centre of the strip 21. During the bonding operation, the strip 21 was heated by an induction field and as a result the heated strip 20 fused with the sheet 22 through the perforations 23 thus bonding the strip 21 to the sheet 22.

In a specific example, a 1" x 4" strip of metalised Mylar (Registered Trade Mark) with a laminated backing of polyvinyl chloride was bonded to an ABS sheet, supplied by O'Sullivan, U.S.A. The vinyl backing had a softening point of about 350°F. The total thickness of the strip was about 85 mils, the thickness of the vinyl layer being about 75 mils. The ABS sheet was about 35 mils thick and had a softening point of about 400°F. It was of the kind commercially used to produce vacuum formed automobile crash pad covers, for example for the 1967 Ford Galaxie.

An 18 mesh steel wire screen was interposed between the strip and the sheet. The wire of the screen was about 11 mils in diameter. The screen was then heated with a handmade "pancake" type induction coil consisting of concentrically wound (6 turns) $\frac{1}{8}$ inch copper tubing in the form of a 3 x 6 inch oval. The coil was operated at approximately 450 KC/S. The coil was applied to the strip with light pressure during the heating. A strong permanent bond was obtained.

WHAT WE CLAIM IS:—

1. A method of bonding together two articles having thermoplastics surfaces, by applying an electromagnetic induction field to a perforated metal member, in contact with the adjacent thermoplastics surfaces of the two articles, so that the heat generated in the metal member by the induction field heats the thermoplastics surfaces sufficiently for the thermoplastics to penetrate the perforations of the metal member, and so that when the surfaces are subsequently allowed to cool, the articles become bonded together.

2. A method according to Claim 1, in which one of the articles is a cast polyvinyl chloride and the other is a metalized plastics component, and in which the articles are held together by a light pressure during the heating.

3. A method according to Claim 1 or Claim 2, in which the adjacent surfaces of the articles are composed of thermoplastics materials of approximately the same fusing point.

4. The method according to any one of the preceding claims in which the perforated metal member is comprised of a metal mesh which is heated sufficiently to cause the thermoplastics to penetrate the interstices of the mesh and come into contact with each other.

5. A pair of articles bonded together by a method according to any one of the preceding claims.

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1205221 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig. 1.

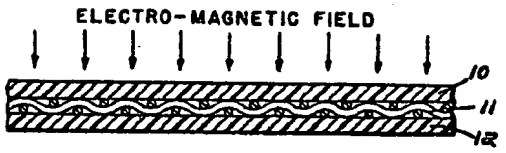

Fig. 2.